A User's Guide to Nonlinear Response Surface Analysis Software Part II: Plotting Response Surface Contours (RSAPLOT)

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PART II: PLOTTING RESPONSE SURFACE CONTOURS (RSAPLOT)

by

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ABSTRACT

Marshall, M. and P. Neaves. 1987. A User's Guide to Nonlinear Respose Surface Analysis Software, Part II: Plotting Response Surface Contours (RSAPLOT). Can. Tech. Rep. Fish. Aquat. Sci. 1553: 51 p.

This report describes the program RSAPLOT developed for the VAX 11/780 with PBGRAPH (a custom graphics package). Hardware and software requirements, and the instructions for the use of RSAPLOT are included. The program must be used in conjunction with a version of response surface parameter estimation as produced by program RSA. RSAPLOT will produce contour lines for two factors simultaneously. In addition, curves indicating lines of optimization, principle axes or asymptotes and an outline of the data window can be produced.

Two companion documents to this guide are: "A User's Guide to Nonlinear Response Surface Analysis Software Part I: Parameter Estimation and Interpretation" by S. McKinnell (1986), and "A Biologically Meaningful Approach to Response surface analysis" by J. Schnute and S. McKinnell (1984).

RESUME

Marshall, M. and P. Neaves. 1987. A User's Guide to Nonlinear Respose Surface Analysis Software, Part II: Plotting Response Surface Contours (RSAPLOT). Can. Tech. Rep. Fish. Aquat. Sci. 1553: 51 p.

Le présent rapport décrit le programme RSAPLOT et le logiciel graphique personnalisé PBGRAPH mis au point pour l'ordinateur VAX 11/780. Sont aussi incluses une description des besoins en matériel et en logiciel et les instructions pour l'utilisation du RSPLOT. Le programme doit être utilisé de concert avec une estimation du paramètre de surface de réaction générée par le programme RSA. De plus, on peut obtenir des courbes indiquant les lignes d'optimisation, les axes principaux ou asymptotes et une ébauche du découpage des données.

On peut consulter deux documents complémentaires du présent guide, soit "A User's Guide to Nonlinear Response Surface Analysis Software Part I: Parameter Estimation and Interpretation" de S. McKinnell (1986) et "A Biologically Meaningful Approach to Response Surface Analysis" de J. Schnute et S. McKinnell (1984).

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1.0 INTRODUCTION

The RSAPLOT program written in FORTRAN 77 was designed to produce plots of contours for response surface models with 2 to 10 independent variables (factors) and one dependant (response) variable (Schnute and McKinnell 1984). The modification of the model from that shown in Lindsey and Sandnes(1972) simplifies data value calculations because they are within the realm of VAX 11/780 computer representation of real numbers. The values for the model parameters are estimated using the simplex search method of nonlinear parameter estimation as described by Mittertreiner and Schnute (1985). The program was recoded and revised for the VAX 11/780 by McKinnell(in prep.) is called RSA (response surface analysis).

The calculations in this program are based on the following formulas in Schnute and Mckinnell (1984).

$$(2.1) \quad \xi_i = (2x_i^{\alpha_i} - U_i^{\alpha_i} - u_i^{\alpha_i})/(U_i^{\alpha_i} - u_i^{\alpha_i})$$

$$(2.2) \quad \eta = (2y^{\gamma} - V^{\gamma} - v^{\gamma})/(V^{\gamma} - v^{\gamma})$$

$$(2.5) \quad \eta = p + \sum_{i=1}^{m} [q_i\xi_i + \sum_{j=i}^{m} r_{ij}\xi_i\xi_j]$$

where y is the response to the m factors y_i(i=1, ..., m), and the quatities v, V, u_i, and U_i(i=1, ..., m) are specified by the user for centering and scaling the data. The parameters (p, q_i, r_{ij}, α_i, γ) determine the shape of the surface in a manner described in detail by Schnute and McKinnell (1984).

RSAPLOT is interactive, menu driven, uses Forms Management Software and outputs plots to a variety of devices supported by the PBGRAPH graphics package. This program calculates values for contour lines, stores them in arrays which are subsequently plotted. The center of the response surface is not required to be within the plotting range. Each pair of factors is plotted upon request. When there are more than two factors, the surface is reduced to two dimensions by the user choosing any fixed slice values for the other factors. Each plot displays a title, the slice values, type of surface, list of contours in ascending order, and labels on each axis. In addition, the data window, lines of optimality, asymptotes or principle axis, or any other line represented by a transformed point and slope can be superimposed on the contour plot. The axis ratio is square for the data window as recommended by Schnute and McKinnell(1984). Many plotting parameter options can be set by the user and current option values can be stored on a file, referred to as a restart file, read during subsequent executions of the program.

2.0 RSAPLOT PROGRAM INTERACTIVE OPERATION

For instructions on use of the TEKTRONIX 4662 plotter, refer to appendix A. See RSAPLOT program flow diagram in appendix B and listings of FMS forms used with this program in appendix C. A sample .SET file with explaination of each line is in appendix D. Appendix E has a listing of line codes for plotting. See Appendix F for an explaination of how to use FMS menus.

2.1 RSA

Run the maximum likelihood RSA program which creates an output file with title, factor labels, response variable labels, exponential transforms, coefficients, typical low and high values for factor and response variable, and response center coordinates. The output file will have a name in VAX file format with extension ".SET".

2.2 Graphic Display Devices

Once ".SET" file has been created and you are ready to create a plot, login to a suitable graphics terminal and type $RSAPLOT. See Appendix C Form: GFHELP - DEVICE SELECTION HELP for a list of devices which work with this program. When using a graphics device with a two level screen, menus and options will be displayed on the dialog screen and plots will be displayed on the graphics screen.

2.2.1 Using A Terminal And A Separate Plotting Device. -

If the terminal is not capable of graphics and displaying two screens simultaneously, you may have another device available to you which will have to be accessed using a logical name "TK:". Enter the command to ensure TK: is assigned to the correct port. At the Pacific Biological Station, for example, the default 'TK': device is the plotting port in the plotting terminal room. To change to another port, for example TTA3:, enter the command "$ASSIGN TTA3: TK:". Menus and options will be displayed on the primary device and plots will be displayed on the secondary device (TK:) .

2.2.2 Plotting Files -

If you are using a VT100 terminal with no graphics device available, you can make a plot file (but not see it) which can later be seen on the chosen device by using the $TYPE command. When entering devices in Initial Device Selection Menu, use 11 for device A and 12 for device B. Enter 3 as answer for RSA output selection menu.

2.3 Restart Files

Since there are so many options being modified by the user, a restart file can be made for using the same ranges for plotting and drawing contours in another session.

2.4 RSAPLOT Slice Selection

A menu is displayed asking the user which pair of factors are to be plotted and at what value to set the remaining factors. This program uses the Forms Management System (FMS) for your responses.

2.5 Contours And Axes Selection

The user is given the option of looking at and or changing the current plotting parameters. If the user responds "yes", then a form with default values is displayed allowing modification of the title, number of contour lines to plot (maximum 10), the values of the contour lines, the number of decimal places in annotation of the axes and contour values, the axes ranges and number of tickmarks to draw for each axis. The names of the factors (from the .SET file) are displayed but can not be modified. Contour values and ranges of axes must be greater than zero. During the parameter setting, no errors are fatal. The values are either reset and displayed or requested to be reentered.

2.6 The Contour Plot

The plot is drawn with a title at the top, slice values and variable names as a subtitle and contours listed in index order beside the righthand side of the graph. Contours are drawn with index value matching order of values listed. The center is marked with a star if it lies within the plotting range. If the plotting device is a hard copy plotter, then the plot is 7 inches square. Do not modify the plotting area in case the data window becomes distorted.

2.7 Plot Point File With Restart Files

If you want to know what points are being plotted, in original data units, request creation of restart files and you will also be asked if you want to make a plot point file whenever you make a restart file.

2.8 Lines Of Optimality And Asymptotes

Once contours are drawn, a menu is displayed which gives the option of drawing a maximum of four additional lines. Each line will have a different pattern and legend entry. If the option to input a point and slope is chosen, then the program prompts for the values of X and Y coordinates, the slope, a label of 4 characters and a line pattern code for drawing the line. The codes are 0 to 9 and are described in appendix E.

2.9 Data Window

If the data window outline box has been requested before the count of other lines reaches four, then a dotted line showing the data window is drawn inside the plot. The menu will be displayed until four lines have been drawn or the choice is to go to the next plot.

3.0 MODIFYING DEFAULT VALUES

All menus display the default value so that pressing <RETURN> will invoke the default response. The default response whenever a question is asked is N for no. Upper and lower case letters work equally as well for responses.

3.1 Axis Annotation

Decimal places and number of tickmarks on the axis should be chosen so that you can read the numbers without them running into one another and that they aren't truncated to the point of distorting the true value.

3.2 Contours

Contours should not be set to zero, or to the slice (center) coordinates. For a minimum surface, contours should be larger in value. For a maximum they should be less than response slice value. For a saddle, they can be above and below the response slice value. Since the plot is square for the data window, choose plotting ranges in similar ratio to the data window parameter ranges for those factors. Poor choice in axis ranges can result in distorted contour lines or missing parts where the model is not well defined.

ACKNOWLEDGMENTS

We appreciate the help we received from Jon Shnute, Skip McKinnell, and Don Alderdice. Whenever discussion was required on an aspect of the model which was not clear, they were available. When there was a stumbling block about how to deal with drawing saddle contour lines, Susan Bates rephrased the problem in such a way that the solution became simple. Thanks go to the people willing to read all of the documentation while it was being prepared, especially Tony Mittertreiner, Bill Damon, Jon Jensen, Jeff Fargo, Ron Tanasichuk and Skip McKinnell. Thanks also go to Gloria Bayntun and Maureen Palmer for their expert advise on publication requirements.

4.0 REFERENCES

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4. McKinnell, S. (in prep.) User's Guide to Nonlinear Response Surface Analysis Software, Part I: Parameter Estimation and Interpretation. Can. Tech. Rep. Fish. Aquat. Sci.

5. Mittertreiner, Anthony and Jon Schnute. 1985. Simplex: A manuel for software package for easy nonlinear parameter estimation and interpretation in fishery research. Can. Tech. Rep. Fish. Aquat. Sci. 1384: 90 p.

5.0 PROGRAM DOCUMENTATION AND FORTRAN SOURCE CODE.

Program documentation, sample execution files and source code are available in machine readable form from the authors. The documentation is about 3500 lines of text and the program is about 3500 lines of FORTRAN 77 code, using DIGITAL FMS™, IMSL™ mathematical library and PBGRAPH plotting library on a VAX 11/780 DEC computer. Send a 9 track magnetic tape with your request, including density (800,1600 BPI), blocking factor, character set, to the Pacific Biological Station, Nanaimo, B.C. V9R 5K6.

6.0 APPENDIX A USING PROGRAM ON THE TEKTRONIX TERMINAL AND PLOTTER.

6.1 Layout Of The 4105, 4662 And The VAX.

At PBS, the 4105 and 4662 are connected to the VAX in a loop-through configuration. The default baud rate for this port is 1200 - the correct speed for the 4662. The 4105, however, can run at speeds up to 9600.

6.2 Use Of The 4662 Plotter:

1. If not installed place a pen in the holder.
2. Power on the plotter.
3. Depress "LOAD". The pen will move to the upper right corner.
4. Place a piece of paper on the surface, covering the screws on the left of the platten.
5. Release "LOAD". The paper will "stick" to the surface. Smooth out any bubbles or wrinkles.
6. Using the joystick, place the pen at the upper right corner of the paper. This will ensure that the pen will not catch the paper.
7. Signal your program that you are ready to plot.
8. When the program you are using is ready to plot, you will be prompted on the Tektronix 4105 screen.
   - o "PLEASE CHANGE PAPER AND PRESS RETURN"
   - o If you have not done 1-6, do so and press the <RETURN> key on the Tektronix 4105.
   - o Replace cap on pen when finished plotting.

6.3 Check List Or Trouble Shooting For Plotter.

- o All buttons on 4662 must be in UP position.
- o The program must not be waiting for a reply.
- o TK: may be assigned to the wrong device.
- o The plotter may produce beeping noises which usually indicates a mismatch between the baud rate of the 4662 or the system parameter value for the port. Since the program sets the system parameter value according to the answer given by you, you should check the device settings or you must start again, giving the correct answer to the program.
- o To stop beeping, press LOCAL (buffers will not be received) and wait for program's next prompt.
- o The last error may not have been cleared. Press LOAD to clear any errors from previous plot.

6.4 Baud Rate For 4662.

At our site, the 4662 baud rate is set at 1200. The 4662 flatbed also runs at slower rates (300 or 600) and if it can not be used without error at 1200 baud, it should be manually adjusted with a screwdriver. You would want to run at a slower speed if a buffer was being lost as indicated by wild beeping noises and/or unpredictable pictures showing on the flatbed plotter.

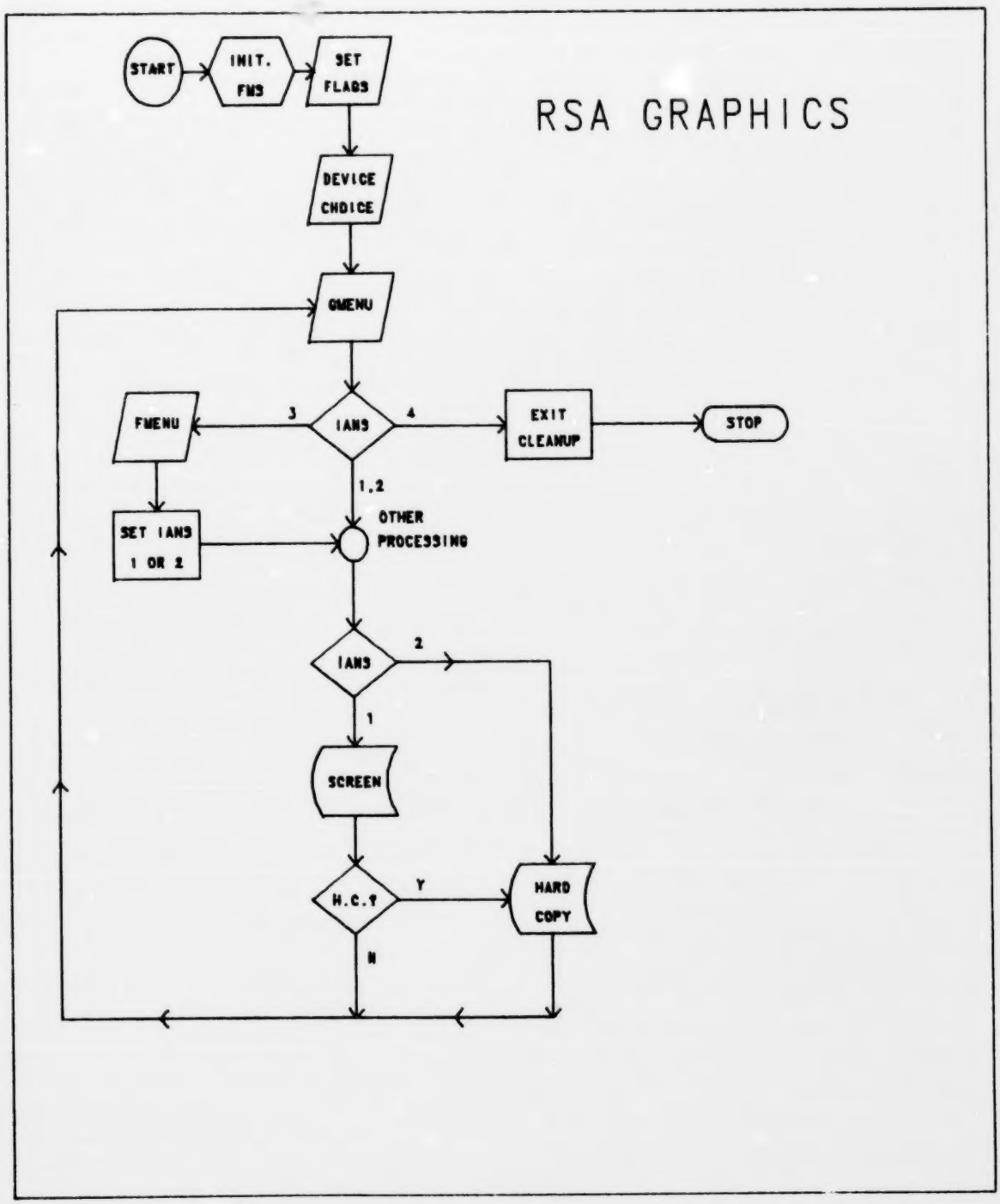
6.5 Help For Use Of Other Graphics Devices.

For other device combinations, use VMS HELP by entering the command

```
$HELP @PBGRAPH DEVICES
```

which will give you the most current information on devices available at our site.

7.0 APPENDIX B RSAPLOT PROGRAM FLOW DIAGRAM



7.1 Files Accessed By RSAPLOT Program.

All files follow VMS naming conventions.

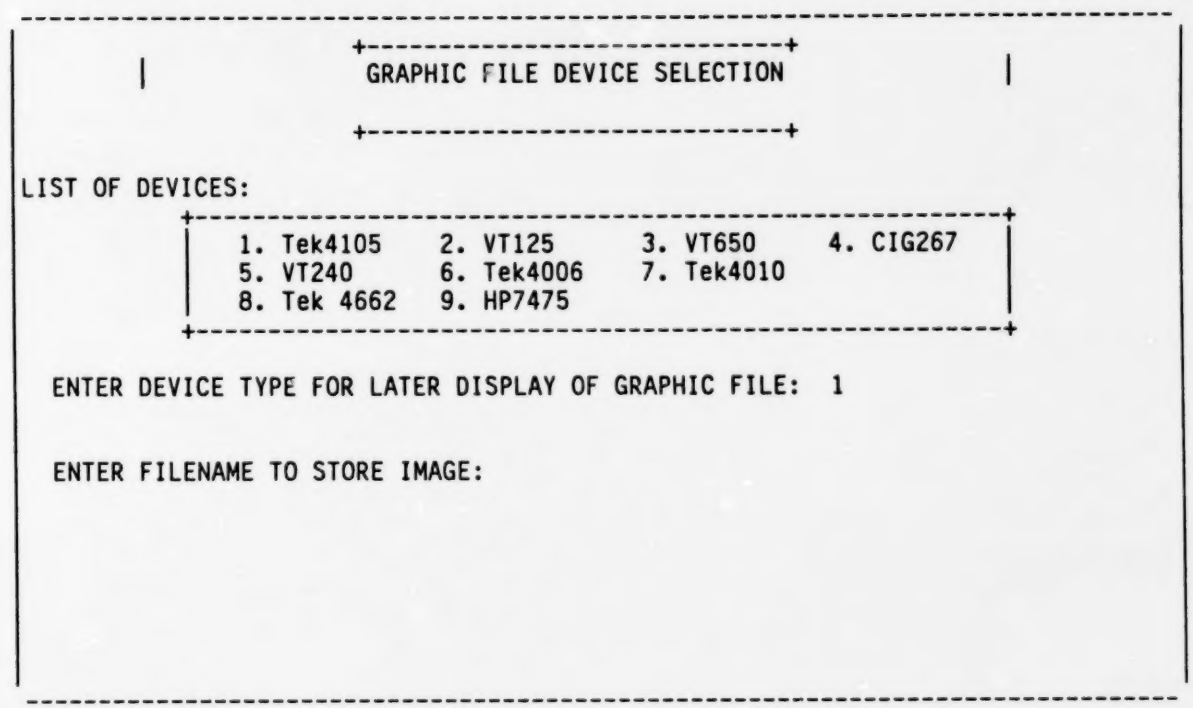
1. Input model file, with .SET extension. (unit 30)
2. Input restart file, with .RST extension. (unit 7)
3. Output restart file, with .RST extension. (unit 7)
4. Output point file, with .PNT extension, unit 20.
5. Screen plot output device. (TT: and unit 6 or TK: and 53)
6. Flatbed plotter output device. (TT: and unit 6 or TK: and 53)
7. Interactive terminal (VT100). (TT: and unit 6)
8. Output plot image file. (unit 52)

8.0 APPENDIX C FORMS LIBRARY INDEX.FLB

8.1 Form: DEVINIT

```
+-------------------------------------------------------------------------------+
|                        +-----------------------+                              |
|                        |  INITIAL DEVICE SELECTION                            |
|                        +-----------------------+                              |
|                                                                               |
| LIST OF DEVICES:                                                              |
| +---------------------------------------------------------------------------+ |
| |STAND ALONE -          1. Tek4105    2. VT125      3. VT650     4. CIG267| |
| |Allocatable -          5. VT240      6. Tek4006    7. Tek4010              | |
| |Plotters               8. Tek 4662   9. HP7475    10. LA100                | |
| |Control only          11. VT100     12. NONE                               | |
| +---------------------------------------------------------------------------+ |
|                                                                               |
|  A.              ENTER TERMINAL YOU ARE TYPING ON:                      1     |
|                                                                               |
|  B.               ENTER TERMINAL TO DISPLAY GRAPHICS:                       1 |
| (If this is not the same as A. then you must have assigned the device to 'TK:')|
|                                                                               |
|  C.          ENTER PLOTTER TYPE:            8                                |
|                                                                               |
+-------------------------------------------------------------------------------+
```

8.2 Form: FMENU



8.3 Form: GFHELP

```
                              DEVICE SELECTION HELP

DEVICES SUPPORTED AT PBS:
    Tek 4006        Tektronix 4006 display terminal
    Tek 4010        Tektronix 4010 display terminal
    Tek 4105        Tektronix 4105 colour display terminal
    CIG 267         CIT-161 terminal with CIG-267 graphics card
    VT125           VT125 terminal - ReGIS graphics
    VT240           VT240 terminal - ReGIS graphics
    Tek 4662        Tektronix 4662 plotter run from Tek 4105 in terminal room.

DEVICES SUPPORTED AT WEST VAN. LAB:
    VT650           VT650 terminal with TEK 4010 emulation
    Tek 4105        Tektronix 4105 colour display terminal
    HP 7475         Hewlett Packard 7475A plotter run from Tek 4105

   If you are using a 4006, 4010, or VT240 then you must allocate the port that
the display device is connected to and run this program from a VT100 compatible
terminal.   Prior to this you must assign the terminal to logical device 'TK:'.
   If you want to save the graphic image and view it later on a device then you
can run this program from a VT100 and save the image in a file.

                                        PRESS <RETURN> TO RETURN TO PROGRAM
```

8.4 Form: GMENU

```
+-------------------------------------------------------------------------------+
|                                                                               |
|                    +-------------------------+                                |
|                    |  RSA OUTPUT SELECTION MENU                               |
|                    +-------------------------+                                |
|                                                                               |
|                                                                               |
|                        1.  DISPLAY ON GRAPHICS TERMINAL                       |
|                                                                               |
|                        2.  CREATE HARDCOPY ON ATTACHED PLOTTER                |
|                                                                               |
|                        3.  SAVE GRAPHIC FILE FOR LATER VIEWING                |
|                                                                               |
|                        4.  EXIT PROGRAM                                       |
|                                                                               |
|                             ENTER CHOICE(        1-4   ):   4                 |
|                                                                               |
|                                                                               |
|                                                                               
```

8.5 Form: LMENU

```
                                                    OPTIONAL LINES
                                                  (Maximum 4 lines)

                                                    Optimum lines:
                                                1               Opt1
                                                2               Opt2
                                                    Asymptotes or
                                                    Principle axes:
                                                3               Pr 1
                                                4               Pr 2
                                                --------------------
                                                5 Determine line:
                                                    Enter values:
                                                              0    XT
                                                              0    YT
                                                              0 slope
                                                    3       dash code
                                                    SepL         label
                                                --------------------
                                                6 Draw data window
                                                7 Exit this menu

                                                  Enter Choice > 7
```

8.6 Form: MODPLT

```
                CHOICES OF PLOTTING OPTIONS TO MODIFY

          1. TITLE -(DEFAULT AS READ FROM FILE).

          2. CONTOURS
                    NUMBER OF CONTOURS
                    CONTOUR VALUES
                    NUMBER OF PLACES IN ANNOTATION

          3. AXIS ANNOTATION
                    DECIMAL PLACES
                    TICK MARKS
                    AXIS RANGES
          4. READY TO PLOT - EXIT FROM THIS FORM.

ENTER CHOICE: 4
```

8.7 Form: NCPLOT

PLOT HEADER:
PLOT SURFACE TYPE:

ANNOTATION

# CONTOURS: 05	# DECIMAL PLACES Y	#TICKS	RANGE OF X'S FOR PLOTTING: START	END	FACTORS
1	X1				
2	X2				
3	X3				
4	X4				
5	X5				
6	X6				
7	X7				
8	X8				
9	X9				
10	X10				

8.8 Form: QUEST

8.9 Form: SLICE

```
                CENTER                  SLICE                                FACTORS
X1              X6                      X1              X6                     PLOT
X2              X7                      X2              X7                      X
X3              X8                      X3              X8                    VS
X4              X9                      X4              X9                      X
X5              X10                     X5              X10


                                                                             FACTORS
```

9.0 APPENDIX D SAMPLE COMMAND FILES AND PLOTS.

9.1 Parameters Which Appear On The .SET Files.

1. Line 1 : Number of factors (M).
2. Line 2 : Experiment title.
3. Next M+1 lines: Labels of variables.
4. Next line: Power transformations (alpha's 1-M, then Gamma)
5. Next : Coefficients for each term in the model.
6. Next : Pairs of high and low values for each factor, then for response variable.
7. Next : Response center values for factors and response variable.

9.2 Sample .SET Command File.

```
 3
Salinity, Temperature and Dissolved O2 Effects on Cod
Salinity
Temperature
Dissolved O2
% Hatch
   3.845383      -0.9684332       -2.209178       0.5048153
  0.5217337      -0.7429546      -0.1294888       0.1238820       0.5517289
  0.7712342       -1.203488      -0.3574559       0.5330541     -2.8236161E-03
   12.70000        27.30000
   2.000000        10.00000
   3.100000        12.40000
  0.8000000        91.70000
   15.60487        3.710868        9.206252        103.5969
```

9.3 Restart File Parameters As They Appear In Order.

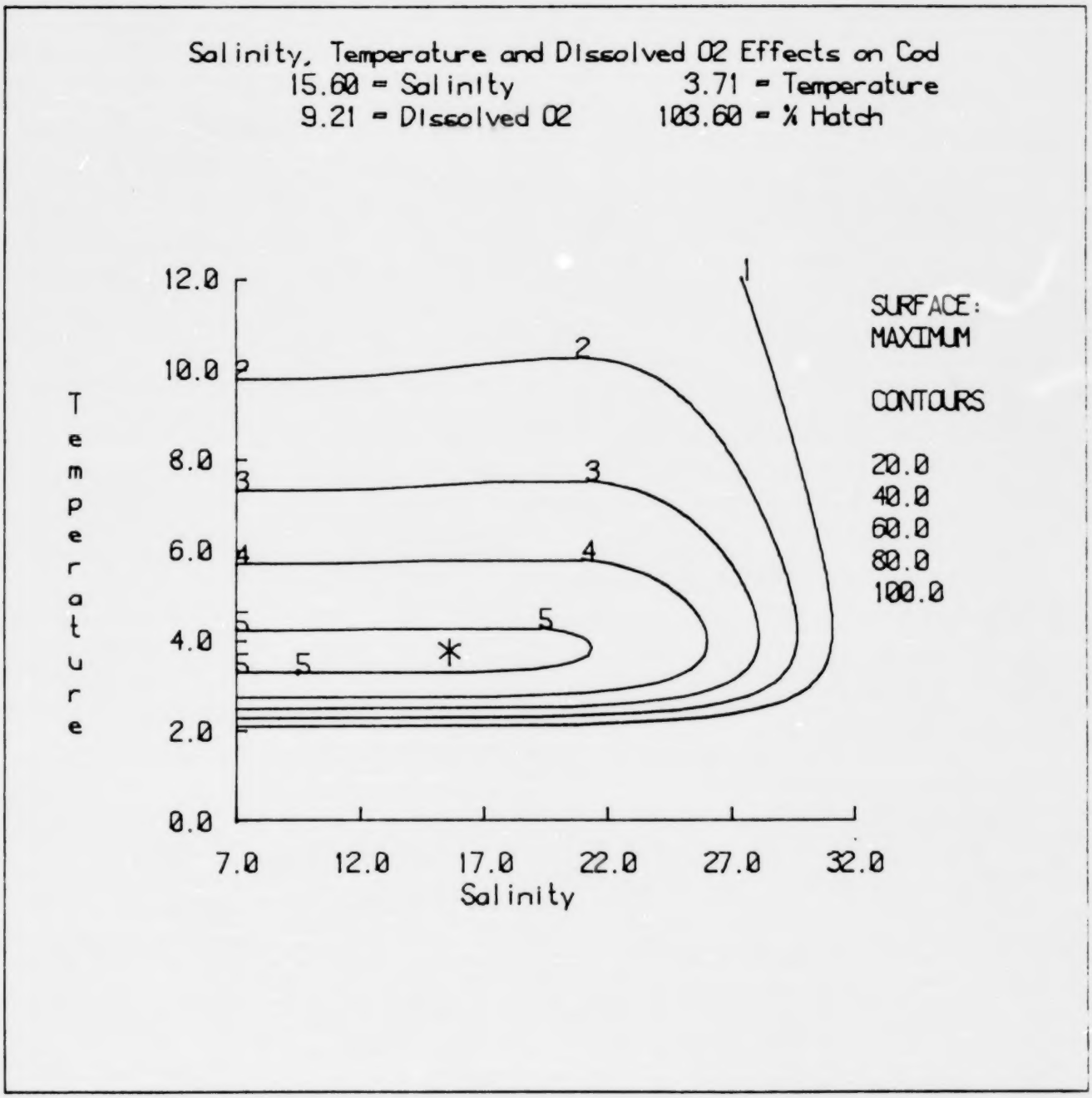
1. The words VERSION 2 are used because there are two versions of restart files. The program decides what parameters are to be read based on this first line. If it is actually the title, it is an old file.
2. Current title for plot.
3. Current plotting choice (1 or 2), Number of factors, two factors to plot and slice values (spills over to second line or more depending on number of factors).
4. Reduced equation coefficients when holding remaining variables at slice value.
5. Surface type.
6. Number of contour lines and their values.
7. Number of decimal places for each axis and response variable annotation.
8. Number of tick marks for each axis.
9. Axis ranges.
10. A number used to verify that the file has not been tampered with.

9.4 Sample Restart File 'COD1.RST', SALINITY Vs TEMPERATURE

This command file was used to produce the plot on the opposite page.

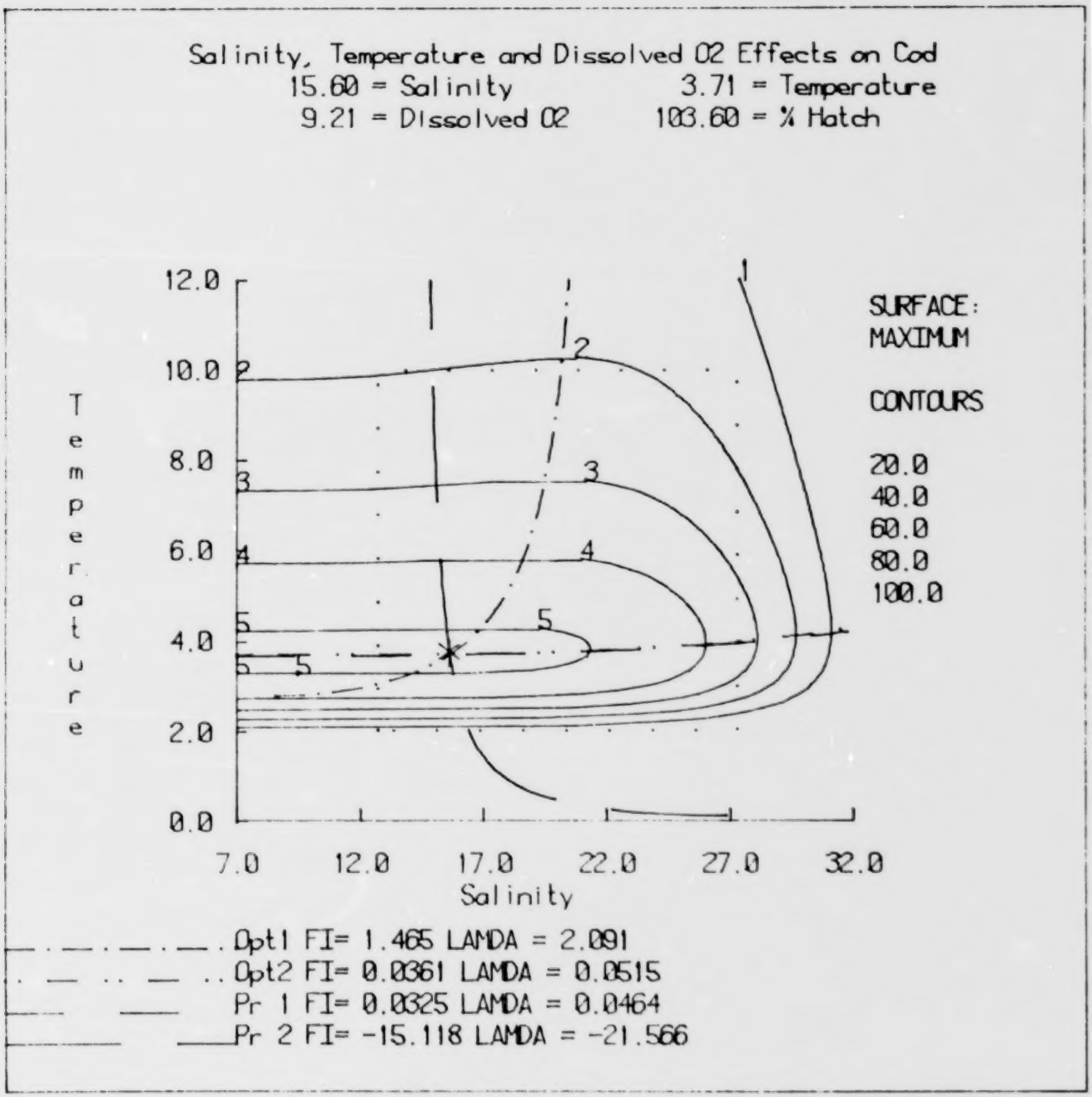
```
VERSION 2
Salinity, Temperature and Dissolved O2 Effects on Cod
         2           3           1           2   15.60487000000000
   3.710868000000000      9.206252000000000      103.5969000000000
   1.003771862136826     -0.2416158322832592     0.4464252214979159
 -0.1294888000000000     -1.203488000000000     0.1238820000000000
  -1.207048533455252     -0.1259282665447479
MAXIMUM
         5   20.00000       40.00000       60.00000       80.00000
   100.0000
         1           1           1           1
         5           6           6
   7.000000       32.00000      0.0000000E+00   12.00000      0.0000000E+00
   14.00000
   376.6665
```

9.5 Plot Figure 1



Sample plot of Salinity vs Temperature

9.6 Plot Figure 2

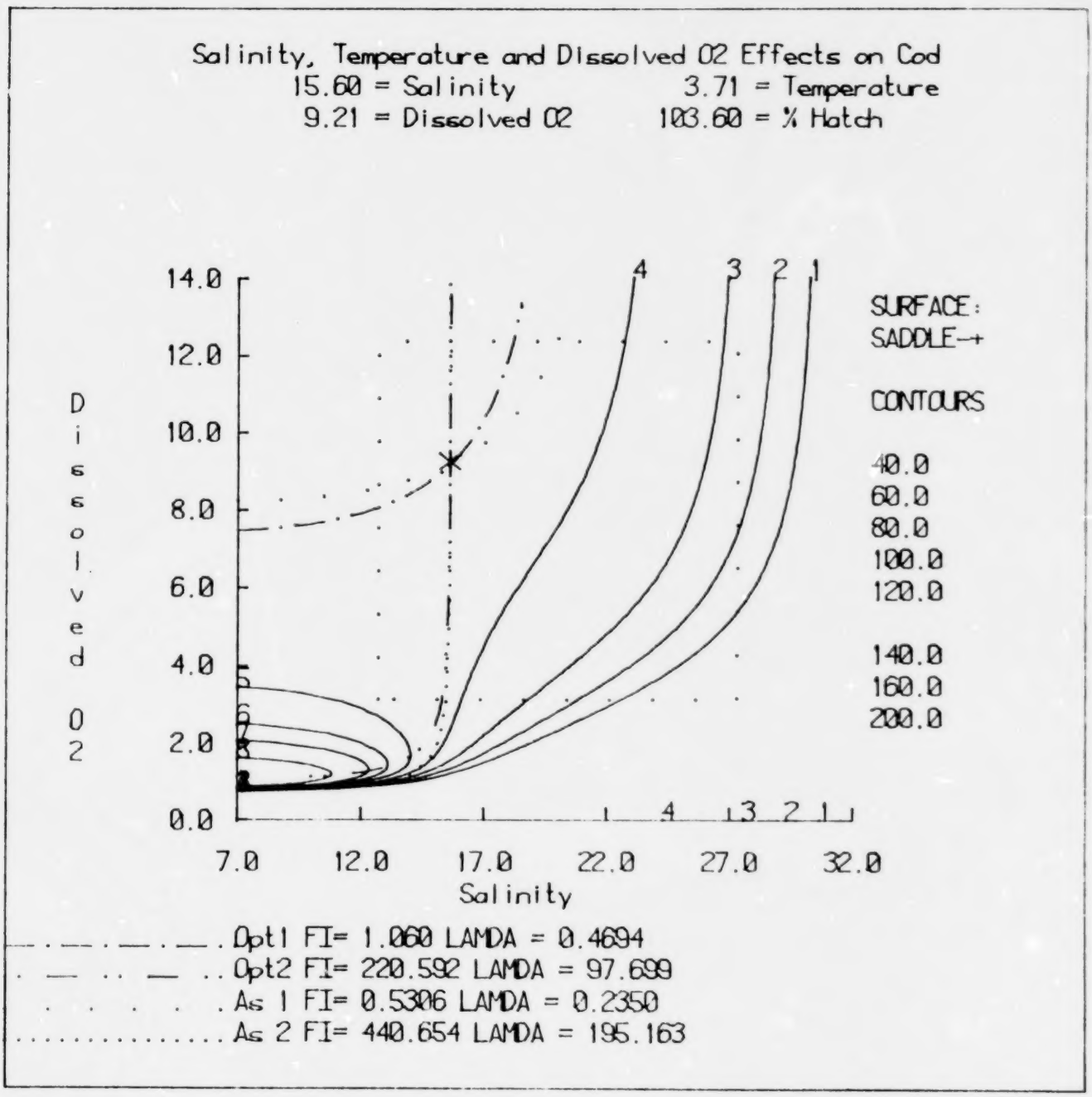


Sample plot of Salinity vs Temperature with optional lines of Optimality, principal axis and data window.

9.7 SAMPLE RESTART FILE 'COD2.RST', SALINITY VS DISSOLVED O2

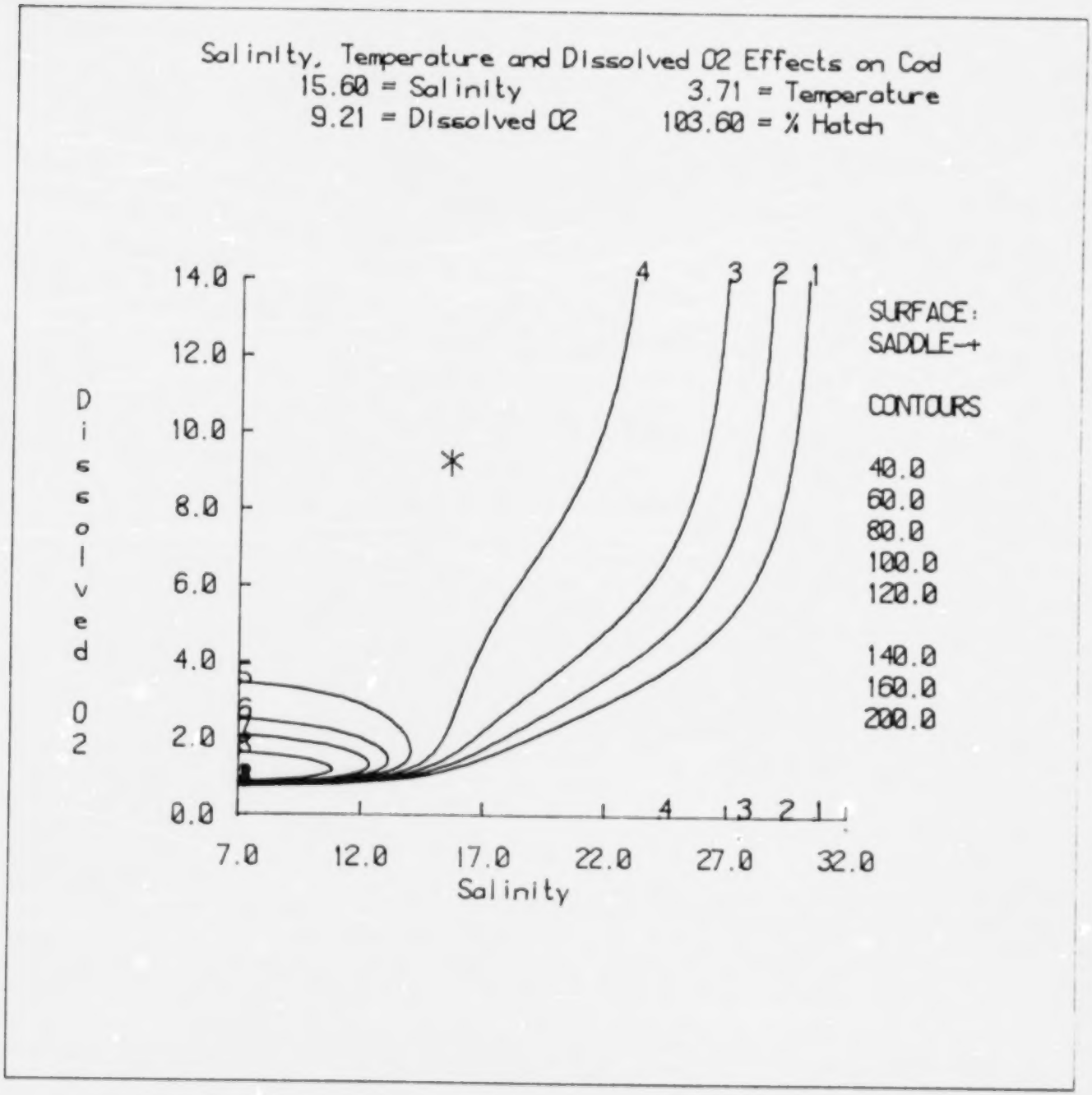
```
VERSION 2
Salinity, Temperature and Dissolved O2 Effects on Cod
           2           3           1           3   15.60487000000000
   3.710868000000000       9.206252000000000       103.5969000000000
  0.6065180801561701     -0.7254967303145020      0.4826802077435591
 -0.1294888000000000     -2.823616100000000E-03   0.5517289000000000
 -0.3491972156388434      0.2168847995388434
SADDLE-+
           8   40.00000       60.00000       80.00000       100.0000
   120.0000       140.0000       160.0000       200.0000
           1           1           1           1
           5           6           7
   7.000000       32.00000      0.0000000E+00   12.00000      0.0000000E+00
   14.00000
   982.6508
```

9.8 Plot Figure 3



Sample plot of Salinity vs Dissolved 02

9.9 Plot Figure 4

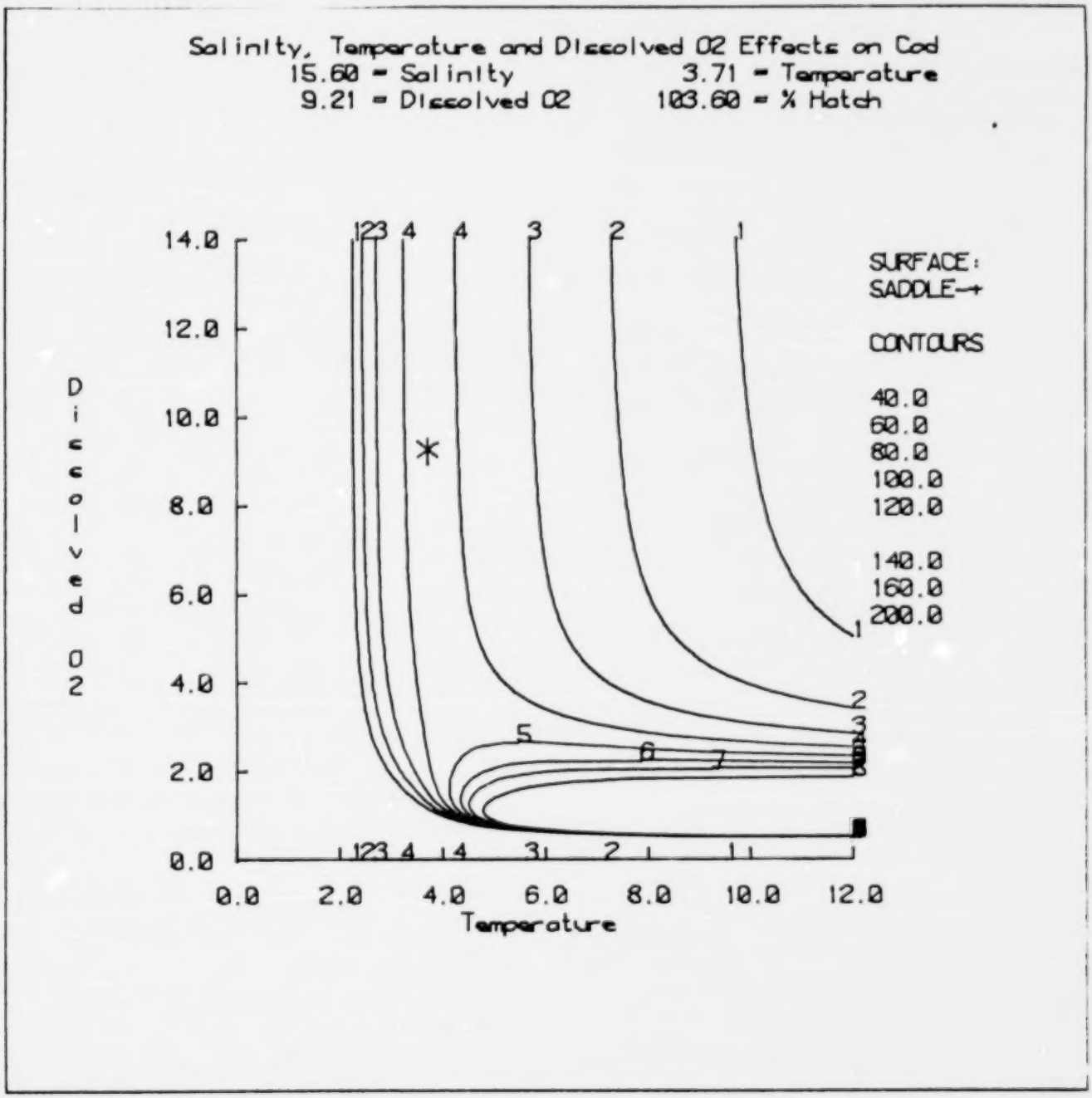


Sample plot of Salinity vs Dissolved 02 with optional lines of optimality, asymptotes and data window.

9.10 SAMPLE RESTART FILE 'COD3.RST', TEMPERATURE VS DISSOLVED O2

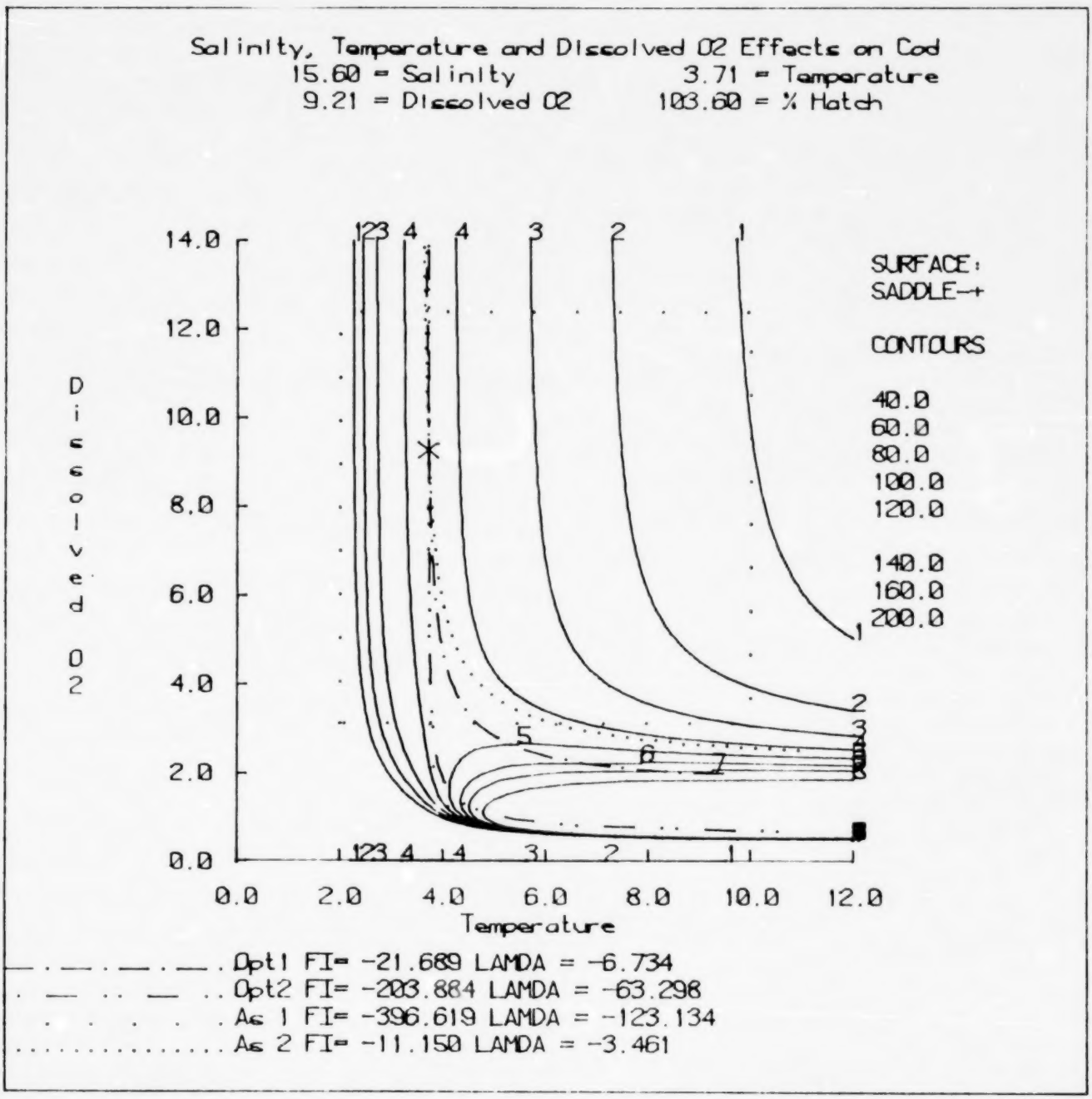
```
VERSION 2
Salinity, Temperature and Dissolved O2 Effects on Cod
          2           3           2           3   15.60487000000000
   3.710868000000000       9.206252000000000       103.5969000000000
   1.067788001018604      0.6640081463302282      5.550520151140481E-02
  -1.203488000000000     -2.823616100000000E-03 -0.3574559000000000
  -1.229528237841330      2.321662174132960E-02
SADDLE-+
          8   40.00000       60.00000       80.00000       100.0000
   120.0000       140.0000       160.0000       200.0000
          1           1           1           1
          5           6           7
   7.000000       32.00000      0.0000000E+00   12.00000      0.0000000E+00
   14.00000
   982.0173
```

9.11 Plot Figure 5



Sample plot of Temperature vs Dissolved O2

9.12 Plot Figure 6

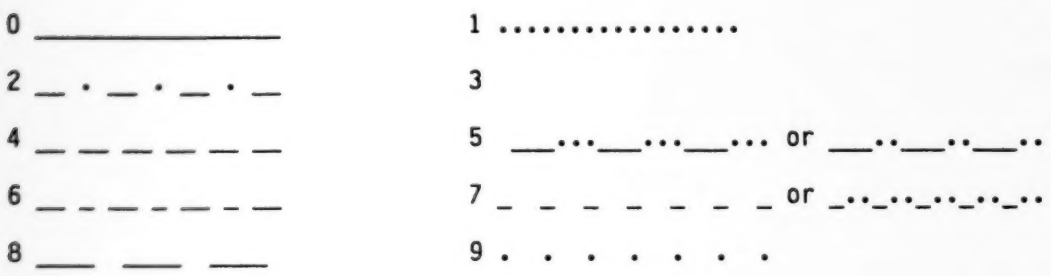


Sample plot of Temperature vs Dissolved O2 with lines of optimality, asymptotes and data window.

9.13 Sample OUTPUT Point File COD.PNT

```
COD
           1           3           1           2   15.60315000000000
3.710896000000000       9.204176000000000       103.5977000000000
   1.004185841348716     -0.2406236099486738      0.4457528559071411
-0.1289155000000000      -1.201973000000000      0.1235277000000000
-1.205516349578737     -0.1253721504212632
   12.00000       28.00000       1.600000       10.40000       3.000000
13.00000
MAXIMUM
           4
   20.00000             151
   2.073196      -19.73728      2.073196      12.00000
   2.101266      -22.98809      2.101266      19.70994
   2.156962      -25.22335      2.156962      23.19584
   2.212658      -26.38887      2.212658      24.88568
   2.268354      -27.15992      2.268354      25.99212
   2.324051      -27.71988      2.324051      26.80154
   2.379747      -28.14743      2.379747      27.42964
   2.435443      -28.48405      2.435443      27.93526
   2.443441      -28.52650      2.443441      28.00000
etc.
```

10.0 APPENDIX E PLOTTING LINE PATTERN CODES FOR SELECTED LINE.



11.0 APPENDIX F USING FORMS MANAGEMENT SYSTEM

The RSAPLOT program uses the forms Management System for enteraing the control parameters. Listed below are the control keys and their functions used with the forms:

PF2	Help key
TAB	Advance to next field in the form
BACKSPACE	Move to the previous field of the form
--->	Move to the right one character
<---	Move to the left one character
DELETE	Delete a character
LINEFEED	Clear a field
CONTROL R	Refresh a screen
RETURN	Signals that form is complete

When a field is completed, the cursor automatically advances to the next field unless it is the last field of the form. When filling numeric fields, leading zeros must be entered. For example:

> To enter a '1' in a field, enter '01' not ' 1', assuming that the field is two positions.

The decimal numbers for this program are being read using character mode so those fields may have leading blanks.

12.0 APPENDIX G SAMPLE SCREENS USING COD1.RST RESTART FILE.

12.1 Device Selection

```
                        +------------------------+
                        |  INITIAL DEVICE SELECTION  |
                        +------------------------+

LIST OF DEVICES:
+-------------------------------------------------------------------------+
|STAND ALONE -          1. Tek4105   2. VT125     3. VT650     4. CiG267|
|Allocatable -          5. VT240     6. Tek4006   7. Tek4010              |
|Plotters               8. Tek 4662  9. HP7475   10. LA100                |
|Control only          11. VT100    12. NONE                             |
+-------------------------------------------------------------------------+

 A.                ENTER TERMINAL YOU ARE TYPING ON:                  11

 B.                ENTER TERMINAL TO DISPLAY GRAPHICS:                12
(If this is not the same as A. then you must have assigned the device to 'TK:')

 C.          ENTER PLOTTER TYPE:          (N/A)
```

12.2 Device Selection For Output To File.

```
+------------------------------------------------------------------------------+
|                                                                              |
|                    +-----------------------------+                           |
|                    |  GRAPHIC FILE DEVICE SELECTION                          |
|                    +-----------------------------+                           |
|                                                                              |
| LIST OF DEVICES:                                                             |
|          +-----------------------------------------------------------+       |
|          |  1. Tek4105    2. VT125      3. VT650      4. CIG267      |       |
|          |  5. VT240      6. Tek4006    7. Tek4010                   |       |
|          |  8. Tek 4662   9. HP7475                                  |       |
|          +-----------------------------------------------------------+       |
|                                                                              |
|   ENTER DEVICE TYPE FOR LATER DISPLAY OF GRAPHIC FILE: 08                    |
|                                                                              |
|   ENTER FILENAME TO STORE IMAGE:  COD1.PLT                                   |
|                                                                              |
|                                                                              |
|                                                                              |
|                                                                              |
|                                                                              |
+------------------------------------------------------------------------------+
```

12.3 Sample Selection Of Saving A File To Be Typed.

```
+-------------------------+
|  RSA OUTPUT SELECTION MENU  |
+-------------------------+

        1.  DISPLAY ON GRAPHICS TERMINAL

        2.  CREATE HARDCOPY ON ATTACHED PLOTTER

        3.  SAVE GRAPHIC FILE FOR LATER VIEWING

        4.  EXIT PROGRAM

            ENTER CHOICE(       1-4   ):   3


If any problems occur running this program contact:
M. Marshall Fisheries and Oceans ,PBS, Nanaimo. (604) 756-7103
```

12.4 Example Menu For Optional Lines Using COD1.RST File.

```
                                                    OPTIONAL LINES
                                                  (Maximum 4 lines)

                                                    Optimum lines:
                                                  1 Salinity      Opt1
                                                  2 Temperature   Opt2
                                                    Asymptotes or
                                                    Principle axes:
                                                  3 Salinity      Pr 1
                                                  4 Temperature   Pr 2
                                                  ---------------------
                                                  5 Determine line:
                                                    Enter values:
                                                              0     XT
                                                              0     YT
                                                              0 slope
                                                    3       dash code
                                                    SepL        label
                                                  ---------------------
                                                  6 Draw data window
                                                  7 Exit this menu

                                                   Enter Choice > 7
```

12.5 Example Choice To Allow Modification Of Contours.

```
                CHOICES OF PLOTTING OPTIONS TO MODIFY

          1. TITLE -(DEFAULT AS READ FROM FILE).

          2. CONTOURS
                    NUMBER OF CONTOURS
                    CONTOUR VALUES
                    NUMBER OF PLACES IN ANNOTATION

          3. AXIS ANNOTATION
                    DECIMAL PLACES
                    TICK MARKS
                    AXIS RANGES
          4. READY TO PLOT - EXIT FROM THIS FORM.

 ENTER CHOICE: 2
```

12.6 Sample Of COD1.RST File Used As Input To The Contour Selection.

```
PLOT HEADER: Salinity, Temperature and Dissolved O2 Effects on Cod
PLOT SURFACE TYPE:MAXIMUM
                                    ANNOTATION
                          # DECIMAL
 # CONTOURS: 05              PLACES    #TICKS  RANGE OF X'S FOR PLOTTING:
                                 Y 1                START            END        FACTORS
 1          20.00             X1 1    05              7.00          32.00  Salinity
 2          40.00             X2 1    06              0.00          12.00  Temperature
 3          60.00             X3 1    06              0.00          14.00  Dissolved O2
 4          80.00             X4
 5         100.00             X5
 6                            X6
 7                            X7
 8                            X8
 9                            X9
10                           X10
Press <RETURN> to finish entry
<TAB> to next field, Press <RETURN> to return to menu
```

12.7 Sample Axis And Slice Value Selection Screen.

```
% Hatch        CENTER       103.597 SLICE      103.597              3   FACTORS
X1         15.605  X6                 X1       15.605  X6                PLOT
X2          3.711  X7                 X2        3.711  X7                 X 1
X3          9.206  X8                 X3        9.206  X8               VS
X4                 X9                 X4                 X9                X 2
X5                 X10                X5                 X10

                                                                    FACTORS
                                                                  Salinity
                                                                  Temperature
                                                                  Dissolved O2

  Change slice now if you wish.
```

Note cursur will be flashing at second occurance of 9.206
waiting fo you to choose a slice value.